SEQUENCE LISTING

<110> Hsueh, Aaron J. W.
      Hsu, Sheau Yu
      Liang, Shan-Guang
      Van Der Spek, Petrus Johannes

<120> Novel Mammalian G-Protein Coupled
  Receptors Having Extracellular Leucine Rich Repeat Regions

<130> STAN-084

<140> 09/647,067
<141> 2000-09-25

<150> PCT/US99/06573
<151> 1999-03-25

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<151> 1998-03-26

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Ser Met Asn Asn Ile Thr Gln Leu Pro Glu Asp Ala Phe Lys Ser Phe
65                  70                  75                  80
Pro Phe Leu Glu Glu Leu Gln Leu Ala Gly Asn Asp Leu Ser Leu Ile
                85                  90                  95
His Pro Lys Ala Leu Ser Gly Leu Lys Glu Leu Lys Val Leu Thr Leu
            100                 105                 110
Gln Asn Asn Gln Leu Arg Thr Val Pro Ser Glu Ala Ile His Gly Leu
            115                 120                 125
Ser Ala Leu Gln Ser Leu Arg Leu Asp Ala Asn His Ile Thr Ser Val
            130                 135                 140
Pro Glu Asp Ser Phe Glu Gly Leu Val Gln Leu Arg His Leu Trp Leu
145                 150                 155                 160
Asp Asp Asn Ser Leu Thr Glu Val Pro Val Arg Pro Leu Ser Asn Leu
                165                 170                 175
Pro Thr Leu Gln Ala Leu Thr Leu Ala Leu Asn Asn Ile Ser Ser Ile
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Pro Asp Phe Ala Phe Thr Asn Leu Ser Ser Leu Val Val Leu His Leu
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2

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Pro Gln Ala Ile Lys Ala Leu Pro Ser Leu Lys Glu Leu Gly Phe His
            245             250             255
Ser Asn Ser Ile Ser Val Ile Pro Asp Gly Ala Phe Gly Gly Asn Pro
            260             265             270
Leu Leu Arg Thr Ile His Leu Tyr Asp Asn Pro Leu Ser Phe Val Gly
        275             280             285
Asn Ser Ala Phe His Asn Leu Ser Asp Leu His Cys Leu Val Ile Arg
    290             295             300
Gly Ala Ser Leu Val Gln Trp Phe Pro Asn Leu Thr Gly Thr Val His
305             310             315             320
Leu Glu Ser Leu Thr Leu Thr Gly Thr Lys Ile Ser Ser Ile Pro Asp
            325             330             335
Asp Leu Cys Gln Asn Gln Lys Met Leu Arg Thr Leu Asp Leu Ser Tyr
            340             345             350
Asn Asn Ile Arg Asp Leu Pro Ser Phe Asn Gly Cys Arg Ala Leu Glu
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Glu Ile Ser Leu Gln Arg Asn Gln Ile Ser Leu Ile Lys Glu Asn Thr
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Phe Gln Gly Leu Thr Ser Leu Arg Ile Leu Asp Leu Ser Arg Asn Leu
385             390             395             400
Ile Arg Glu Ile His Ser Gly Ala Phe Ala Lys Leu Gly Thr Ile Thr
            405             410             415
Asn Leu Asp Val Ser Phe Asn Glu Leu Thr Ser Phe Pro Thr Glu Gly
            420             425             430
Leu Asn Gly Leu Asn Gln Leu Lys Leu Val Gly Asn Phe Lys Leu Lys
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Asp Ala Leu Ala Ala Arg Asp Phe Ala Asn Leu Arg Ser Leu Ser Val
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Pro Tyr Ala Tyr Gln Cys Cys Ala Phe Trp Gly Cys Asp Ser Leu Cys
465             470             475             480
Lys Leu Asn Thr Glu Asp Asn Ser Pro Gln Glu His Ser Val Thr Lys
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Glu Lys Gly Ala Thr Asp Ala Ala Asn Val Thr Ser Thr Ala Glu Asn
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Glu Glu His Ser Gln Ile Ile Ile His Cys Thr Pro Ser Thr Gly Ala
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Val Trp Phe Ile Phe Leu Val Ala Leu Leu Phe Asn Leu Leu Val Ile
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Ile Gly Leu Ile Ser Val Ser Asn Leu Leu Met Gly Ile Tyr Thr Gly
        580             585             590
Ile Leu Thr Phe Leu Asp Ala Val Ser Trp Gly Arg Phe Ala Glu Phe
    595             600             605
Gly Ile Trp Trp Glu Thr Gly Ser Gly Cys Lys Val Ala Gly Ser Leu
    610             615             620
Ala Val Phe Ser Ser Glu Ser Ala Val Phe Leu Leu Thr Leu Ala Ala
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Val Glu Arg Ser Val Phe Ala Lys Asp Leu Met Lys His Gly Lys Ser
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Ser His Leu Arg Gln Phe Gln Val Ala Ala Leu Leu Ala Leu Leu Gly
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3

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Gly Phe Thr Val Thr Leu Val Leu Leu Asn Ser Leu Ala Phe Leu Leu
705                 710                 715                 720
Met Ala Ile Ile Tyr Thr Lys Leu Tyr Cys Asn Leu Glu Lys Glu Asp
                725                 730                 735
Leu Ser Glu Asn Ser Gln Ser Ser Val Ile Lys His Val Ala Trp Leu
                740                 ·745                750
Ile Phe Thr Asn Cys Ile Phe Phe Cys Pro Val Ala Phe Phe Ser Phe
                755                 760                 765
Ala Pro Leu Ile Thr Ala Ile Ser Ile Ser Pro Glu Ile Met Lys Ser
        770                 775                 780
Val Thr Leu Ile Phe Phe Pro Leu Pro Ala Cys Leu Asn Pro Val Leu
785                 790                 795                 800
Tyr Val Phe Phe Asn Pro Lys Phe Lys Glu Asp Trp Lys Leu Leu Lys
                805                 810                 815
Arg Arg Val Thr Arg Lys His Gly Ser Val Ser Val Ser Ile Ser Ser
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Gln Gly Gly Cys Gly Glu Gln Asp Phe Tyr Tyr Asp Cys Gly Met Tyr
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Ser His Leu Gln Gly Asn Leu Thr Val Cys Asp Cys Cys Glu Ser Phe
        850                 855                 860
Leu Leu Thr Lys Pro Val Ser Cys Lys His Leu Ile Lys Ser His Ser
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Cys Pro Val Leu Thr Ala Ala Ser Cys Gln Arg Pro Glu Ala Tyr Trp
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Ser Asp Cys Gly Thr Gln Ser Ala His Ser Asp Tyr Ala Asp Glu Glu
        900                 905                 910
Asp Ser Phe Val Ser Asp Ser Ser Asp Gln Val Gln Ala Cys Gly Arg
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Ala Cys Phe Tyr Gln Ser Arg Gly Phe Pro Leu Val Arg Tyr Ala Tyr
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4

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Asp Glu Phe Pro Thr Ala Ile Arg Thr Leu Ser Asn Leu Lys Glu Leu
         35                  40                  45
Gly Phe His Ser Asn Asn Ile Arg Ser Ile Pro Glu Lys Ala Phe Val
     50                  55                  60
Gly Asn Pro Ser Leu Ile Thr Ile His Phe Tyr Asp Asn Pro Ile Gln
65                  70                  75                  80
Phe Val Gly Arg Ser Ala Phe Gln His Leu Pro Glu Leu Arg Thr Leu
                 85                  90                  95
Thr Leu Asn Gly Ala Ser Gln Ile Thr Glu Phe Pro Asp Leu Thr Gly
             100                 105                 110
Thr Ala Asn Leu Glu Ser Leu Thr Leu Thr Gly Ala Gln Ile Ser Ser
             115                 120                 125
Leu Pro Gln Thr Val Cys Asn Gln Leu Pro Asn Leu Gln Val Leu Asp
     130                 135                 140
Leu Ser Tyr Asn Leu Leu Glu Asp Leu Pro Ser Phe Ser Val Cys Gln
145                 150                 155                 160
Lys Leu Gln Lys Ile Asp Leu Arg His Asn Glu Ile Tyr Glu Ile Lys
                 165                 170                 175
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5

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Trp Asn Lys Ile Ala Ile Ile His Pro Asn Ala Phe Ser Thr Leu Pro
        195             200             205
Ser Leu Ile Lys Leu Asp Leu Ser Ser Asn Leu Leu Ser Ser Phe Pro
    210             215             220
Ile Thr Gly Leu His Gly Leu Thr His Leu Lys Leu Thr Gly Asn His
225             230             235             240
Ala Leu Gln Ser Trp Ile Ser Ser Glu Asn Phe Pro Glu Leu Lys Val
            245             250             255
Ile Glu Met Pro Tyr Ala Tyr Gln Cys Cys Ala Phe Gly Val Cys Glu
        260             265             270
Asn Ala Tyr Lys Ile Ser Asn Gln Trp Asn Lys Gly Asp Asn Ser Ser
        275             280             285
Met Asp Asp Leu His Lys Lys Asp Ala Gly Met Phe Gln Ala Gln Asp
290             295             300
Glu Arg Asp Leu Glu Asp Phe Leu Leu Asp Phe Glu Glu Asp Leu Lys
305             310             315             320
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Cys Glu His Leu Leu Asp Gly Trp Leu Ile Arg Ile Gly Val Trp Thr
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Phe Arg Ser Pro Leu Tyr Ile Ser Pro Ile Lys Leu Leu Ile Gly Val
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Ile Ala Ala Val Asn Met Leu Thr Gly Val Ser Ser Ala Val Leu Ala
385             390             395             400
Gly Val Asp Ala Phe Thr Phe Gly Ser Phe Ala Arg His Gly Ala Trp
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Trp Glu Asn Gly Val Gly Cys His Val Ile Gly Phe Leu Ser Ile Phe
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Ala Ser Glu Ser Ser Val Phe Leu Leu Thr Leu Ala Ala Leu Glu Arg
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Ser Ser Leu Lys Val Ile Ile Leu Leu Cys Ala Leu Leu Ala Leu Thr
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Met Ala Ala Val Pro Leu Leu Gly Gly Ser Lys Tyr Gly Ala Ser Pro
            485             490             495
Leu Cys Leu Pro Leu Pro Phe Gly Glu Pro Ser Thr Met Gly Tyr Met
        500             505             510
Val Ala Leu Ile Leu Leu Asn Ser Leu Cys Phe Leu Met Met Thr Ile
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Ile Trp Asp Cys Ser Met Val Lys His Ile Ala Leu Leu Leu Phe Thr
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Asn Cys Ile Leu Asn Cys Pro Val Ala Phe Leu Ser Phe Ser Ser Leu
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Ile Asn Leu Thr Phe Ile Ser Pro Glu Val Ile Lys Phe Ile Leu Leu
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Val Val Val Pro Leu Pro Ala Cys Leu Asn Pro Leu Leu Tyr Ile Leu
            595             600             605
Phe Asn Pro His Phe Lys Glu Asp Leu Val Ser Leu Arg Lys Gln Thr
    610             615             620
Tyr Val Trp Thr Arg Ser Lys His Pro Ser Leu Met Ser Ile Asn Ser
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  1               5                  10                  15
Phe Ser His Gly Gly Gly Gln Asp Val Lys Cys Ser Leu Gly Tyr Phe
                 20                  25                  30
Pro Cys Gly Asn Ile Thr Lys Cys Leu Pro Gln Leu Leu His Cys Asn
             35                  40                  45
Gly Val Asp Asp Cys Gly Asn Gln Ala Asp Glu Asp Asn Cys Gly Asp
         50                  55                  60
Asn Asn Gly Trp Ser Met Gln Phe Asp Lys Tyr Phe Ala Ser Tyr Tyr
65                  70                  75                  80
Lys Met Thr Ser Gln Tyr Pro Phe Glu Ala Glu Thr Pro Glu Cys Leu
                 85                  90                  95
Val Gly Ser Val Pro Val Gln Cys Leu Cys Gln Gly Leu Glu Leu Asp
                100                 105                 110
Cys Asp Glu Thr Asn Leu Arg Ala Val Pro Ser Val Ser Ser Asn Val
             115                 120                 125
Thr Ala Met Ser Leu Gln Trp Asn Leu Ile Arg Lys Leu Pro Pro Asp
         130                 135                 140
Cys Phe Lys Asn Tyr His Asp Leu Gln Lys Leu Tyr Leu Gln Asn Asn
145                 150                 155                 160
Lys Ile Thr Ser Ile Ser Ile Tyr Ala Phe Arg Gly Leu Asn Ser Leu
                 165                 170                 175
Thr Lys Leu Tyr Leu Ser His Asn Arg Ile Thr Phe Leu Lys Pro Gly
                 180                 185                 190
Val Phe Glu Asp Leu His Arg Leu Glu Trp Leu Ile Ile Glu Asp Asn
             195                 200                 205
His Leu Ser Arg Ile Ser Pro Pro Thr Phe Tyr Gly Leu Asn Ser Leu
         210                 215                 220
Ile Leu Leu Val Leu Met Asn Asn Val Leu Thr Arg Leu Pro Asp Lys
225                 230                 235                 240
Pro Leu Cys Gln His Met Pro Arg Leu His Trp Leu Asp Leu Glu Gly
                 245                 250                 255
Asn His Ile His Asn Leu Arg Asn Leu Thr Phe Ile Ser Cys Ser Asn
             260                 265                 270
Leu Thr Val Leu Val Met Arg Lys Asn Lys Ile Asn His Leu Asn Glu
         275                 280                 285
Asn Thr Phe Ala Pro Leu Gln Lys Leu Asp Glu Leu Asp Leu Gly Ser
         290                 295                 300
Asn Lys Ile Glu Asn Leu Pro Pro Leu Ile Phe Lys Asp Leu Lys Glu
305                 310                 315                 320
Leu Ser Gln Leu Asn Leu Ser Tyr Asn Pro Ile Gln Lys Ile Gln Ala
                 325                 330                 335
Asn Gln Phe Asp Tyr Leu Val Lys Leu Lys Ser Leu Ser Leu Glu Gly
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Ile Glu Ile Ser Asn Ile Gln Gln Arg Met Phe Arg Pro Leu Met Asn
         355                 360                 365
Leu Ser His Ile Tyr Phe Lys Lys Phe Gln Tyr Cys Gly Tyr Ala Pro
         370                 375                 380
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8

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His Val Arg Ser Cys Lys Pro Asn Thr Asp Gly Ile Ser Ser Leu Glu
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Asn Leu Leu Ala Ser Ile Ile Gln Arg Val Phe Val Trp Val Val Ser
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Ala Val Thr Cys Phe Gly Asn Ile Phe Val Ile Cys Met Arg Pro Tyr
            420             425             430
Ile Arg Ser Glu Asn Lys Leu Tyr Ala Met Ser Ile Ile Ser Leu Cys
        435             440             445
Cys Ala Asp Cys Leu Met Gly Ile Tyr Leu Phe Val Ile Gly Gly Phe
    450             455             460
Asp Leu Lys Phe Arg Gly Glu Tyr Asn Lys His Ala Gln Leu Trp Met
465             470             475                     480
Glu Ser Thr His Cys Gln Leu Val Gly Ser Leu Ala Ile Leu Ser Thr
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Glu Val Ser Val Leu Leu Leu Thr Phe Leu Thr Leu Glu Lys Tyr Ile
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Cys Ile Val Tyr Pro Phe Arg Cys Val Arg Pro Gly Lys Cys Arg Thr
        515             520             525
Ile Thr Val Leu Ile Leu Ile Trp Ile Thr Gly Phe Ile Val Ala Phe
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Ile Pro Leu Ser Asn Lys Glu Phe Phe Lys Asn Tyr Tyr Gly Thr Asn
545             550             555                     560
Gly Val Cys Phe Pro Leu His Ser Glu Asp Thr Glu Ser Ile Gly Ala
            565             570             575
Gln Ile Tyr Ser Val Ala Ile Phe Leu Gly Ile Asn Leu Ala Ala Phe
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Ile Ile Ile Val Phe Ser Tyr Gly Ser Met Phe Tyr Ser Val His Gln
        595             600             605
Ser Ala Ile Thr Ala Thr Glu Ile Arg Asn Gln Val Lys Lys Glu Met
    610             615             620
Ile Leu Ala Lys Arg Phe Phe Phe Ile Val Phe Thr Asp Ala Leu Cys
625             630             635                     640
Trp Ile Pro Ile Phe Val Val Lys Phe Leu Ser Leu Leu Gln Val Glu
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Ile Pro Gly Thr Ile Thr Ser Trp Val Val Ile Phe Ile Leu Pro Ile
            660             665             670
Asn Ser Ala Leu Asn Pro Ile Leu Tyr Thr Leu Thr Thr Arg Pro Phe
        675             680             685
Lys Glu Met Ile His Arg Phe Trp Tyr Asn Tyr Arg Gln Arg Lys Ser
        690             695             700
Met Asp Ser Lys Gly Gln Lys Thr Tyr Ala Pro Ser Phe Ile Trp Val
705             710             715                     720
Glu Met Trp Pro Leu Gln Glu Met Pro Pro Glu Leu Met Lys Pro Asp
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Leu Phe Thr Tyr Pro Cys Glu Met Ser Leu Ile Ser Gln Ser Thr Arg
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Leu Asn Ser Tyr Ser
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9

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10

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<212> PRT
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Phe Ser His Gly Gly Gly Gln Asp Val Lys Cys Ser Leu Gly Tyr Phe
            20                  25                  30
Pro Cys Gly Asn Ile Thr Lys Cys Leu Pro Gln Leu Leu His Cys Asn
            35                  40                  45
Gly Val Asp Asp Cys Gly Asn Gln Ala Asp Glu Asp Asn Cys Val Val
        50                  55                  60
Val Leu Cys Gln Cys Met Ser Leu Pro Gly Leu Glu Leu Asp Trp Met
65                  70                  75                  80
Lys Pro Phe Thr Ser Val Pro Ser Val Ser Ser Asn Val Thr Ala Met
                85                  90                  95
Ser Leu Gln Trp Asn Leu Ile Arg Lys Leu Pro Pro Asp Cys Phe Lys
            100                 105                 110
Asn Tyr His Asp Leu Gln Lys Leu Asp Leu Gln Asn Asn Lys Ile Thr
            115                 120                 125
Ser Ile Ser Ile Tyr Ala Phe Arg Gly Leu Asn Ser Leu Thr Lys Leu
        130                 135                 140
Tyr Leu Ser His Asn Arg Ile Thr Phe Leu Lys Pro Gly Val Phe Glu
145                 150                 155                 160
Asp Leu His Arg Leu Glu Trp Leu Ile Ile Glu Asp Asn His Leu Ser
                165                 170                 175
Arg Ile Ser Pro Pro Thr Phe Tyr Gly Leu Asn Ser Leu Ile Leu Leu
            180                 185                 190
Val Leu Met Asn Asn Val Leu Thr Arg Leu Pro Asp Lys Pro Leu Cys
            195                 200                 205
Gln His Met Pro Arg Leu His Trp Leu Asp Leu Glu Gly Asn His Ile
        210                 215                 220
His Asn Leu Arg Asn Leu Thr Phe Ile Ser Cys Ser Asn Leu Thr Val
225                 230                 235                 240
Leu Val Met Arg Lys Asn Lys Ile Asn His Leu Asn Glu Asn Thr Phe
                245                 250                 255
Ala Pro Leu Gln Lys Leu Asp Glu Leu Asp Leu Gly Ser Asn Lys Ile
            260                 265                 270
Glu Asn Leu Pro Pro Leu Ile Phe Lys Asp Leu Lys Glu Leu Ser Gln
            275                 280                 285
Leu Asn Leu Ser Tyr Asn Pro Ile Gln Lys Ile Gln Ala Asn Gln Phe
        290                 295                 300
Asp Tyr Leu Val Lys Leu Lys Ser Leu Ser Leu Glu Gly Ile Glu Ile
305                 310                 315                 320
Ser Asn Ile Gln Gln Arg Met Phe Arg Pro Leu Met Asn Leu Ser His
                325                 330                 335
Ile Tyr Phe Lys Lys Phe Gln Tyr Cys Gly Tyr Ala Pro His Val Arg
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          370                      375                      380
     Cys Phe Gly Asn Ile Phe Val Ile Cys Met Arg Pro Tyr Ile Arg Ser
     385                      390                      395                      400
     Glu Asn Lys Leu Tyr Ala Met Ser Ile Ile Ser Leu Cys Cys Ala Asp
                      405                      410                      415
     Cys Leu Met Gly Ile Tyr Leu Phe Val Ile Gly Gly Phe Asp Leu Lys
                  420                      425                      430
     Phe Arg Gly Glu Tyr Asn Lys His Ala Gln Leu Trp Met Glu Ser Thr
              435                      440                      445
     His Cys Gln Leu Val Gly Ser Leu Ala Ile Leu Ser Thr Glu Val Ser
          450                      455                      460
     Val Leu Leu Leu Thr Phe Leu Thr Leu Glu Lys Tyr Ile Cys Ile Val
     465                      470                      475                      480
     Tyr Pro Phe Arg Cys Val Arg Pro Gly Lys Cys Arg Thr Ile Thr Val
                  485                      490                      495
     Leu Ile Leu Ile Trp Ile Thr Gly Phe Ile Val Ala Phe Ile Pro Leu
              500                      505                      510
     Ser Asn Lys Glu Phe Phe Lys Asn Tyr Tyr Gly Thr Asn Gly Val Cys
              515                      520                      525
     Phe Pro Leu His Ser Glu Asp Thr Glu Ser Ile Gly Ala Gln Ile Tyr
          530                      535                      540
     Ser Val Ala Ile Phe Leu Gly Ile Asn Leu Ala Ala Phe Ile Ile Ile
     545                      550                      555                      560
     Val Phe Ser Tyr Gly Ser Met Phe Tyr Ser Val His Gln Ser Ala Ile
                  565                      570                      575
     Thr Ala Thr Glu Ile Arg Asn Gln Val Lys Lys Glu Met Ile Leu Ala
              580                      585                      590
     Lys Arg Phe Phe Phe Ile Val Phe Thr Asp Ala Leu Cys Trp Ile Pro
              595                      600                      605
     Ile Phe Val Val Lys Phe Leu Ser Leu Leu Gln Val Glu Ile Pro Gly
          610                      615                      620
     Thr Ile Thr Ser Trp Val Val Ile Phe Ile Leu Pro Ile Asn Ser Ala
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     Leu Asn Pro Ile Leu Tyr Thr Leu Thr Thr Arg Pro Phe Lys Glu Met
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     Ile His Arg Phe Trp Tyr Asn Tyr Arg Gln Arg Lys Ser Met Asp Ser
                  660                      665                      670
     Lys Gly Gln Lys Thr Tyr Ala Pro Ser Phe Ile Trp Val Glu Met Trp
              675                      680                      685
     Pro Leu Gln Glu Met Pro Pro Glu Leu Met Lys Pro Asp Leu Phe Thr
          690                      695                      700
     Tyr Pro Cys Glu Met Ser Leu Ile Ser Gln Ser Thr Arg Leu Asn Ser
     705                      710                      715                      720
     Tyr Ser
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